

# The Galactic center X-ray transients AX J1745.6–2901 and GRS 1741–2853

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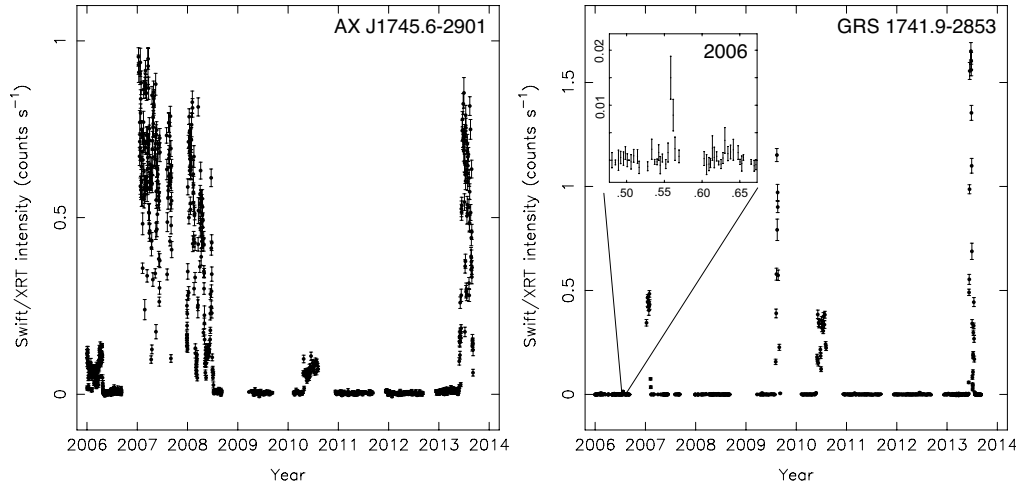
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**Abstract.** AX J1745.6–2901 and GRS 1741–2853 are two transient neutron star low-mass X-ray binaries that are located within  $\simeq 10'$  from the Galactic center. Multi-year monitoring observations with the *Swift*/XRT has exposed several accretion outbursts from these objects. We report on their updated X-ray light curves and renewed activity that occurred in 2010–2013.

**Keywords.** accretion, accretion disks, stars: neutron, X-rays: binaries

## 1. Introduction

*Swift* has monitored the inner  $\simeq 25' \times 25'$  of the Milky Way with the onboard X-Ray Telescope since 2006, using  $\simeq 1$  ks exposures performed every 1–4 days. This has amounted to nearly 1000 observations and  $\simeq 1.1$  Ms of exposure time between 2006 and 2013. This campaign provides a perfect setup to study the long-term X-ray behavior of the supermassive black hole Sgr A\*, as well as 15 known transient low-mass X-ray binaries (e.g., Degenaar & Wijnands 2009, 2010; Degenaar et al. 2013). AX J1745.6–2901 and GRS 1741–2853 are two neutron star low-mass X-ray binaries that are frequently active; both exhibited two main outbursts in the period 2006–2009 (Degenaar & Wijnands 2009, 2010, see also Figure 1).



**Figure 1.** *Swift*/XRT light curves of AX J1745.6–2901 and GRS 1741–2853 (2006–2013). Both sources exhibited four main outbursts. GRS 1741–2853 also displayed a very weak ( $L_X^{\text{peak}} \simeq 7 \times 10^{34}$  erg s $^{-1}$ ) and short ( $\simeq 1$  week) outburst in 2006 (Degenaar & Wijnands 2009).

**Table 1.** Spectral Properties of the New Outbursts of AX J1745.6–2901 and GRS 1741–2853.

Year	$N_H$	$\Gamma$	$\chi^2/\text{dof}$	$F_X^{\text{unabs}}$	$L_X$	$L_X^{\text{peak}}$	$t_{\text{ob}}$	$f$
<b>AX J1745.6–2901</b>								
2010	$2.0 \pm 0.2$	$2.0 \pm 0.3$	111/109	$0.4 \pm 0.1$	$2.7 \pm 0.5$	$\simeq 5.6$	20–34	$\simeq 4.3\text{--}7.4$
2013	$2.0 \pm 0.1$	$2.6 \pm 0.1$	567/472	$3.3 \pm 0.2$	$25 \pm 1.0$	$\simeq 67$	$\gtrsim 16$	$\gtrsim 32$
<b>GRS 1741–2853</b>								
2010	$1.3 \pm 0.8$	$2.2 \pm 0.2$	252/222	$1.2 \pm 0.1$	$6.3 \pm 0.4$	$\simeq 14$	$\simeq 13$	$\simeq 9.5$
2013	$1.4 \pm 0.1$	$2.9 \pm 0.1$	443/434	$8.2 \pm 0.4$	$44 \pm 2.0$	$\simeq 230$	$\simeq 6$	$\simeq 30$

Note.— Quoted errors refer to 90% confidence levels. The hydrogen column density ( $N_H$ ) is in units of  $10^{23} \text{ cm}^{-2}$ . Unabsorbed fluxes ( $F_X^{\text{unabs}}$ ) are in units of  $10^{-10} \text{ erg cm}^{-2} \text{ s}^{-1}$  and for the 2–10 keV energy range. Fluences ( $f$ , in units of  $10^{-4} \text{ erg cm}^{-2}$ ) were estimated by multiplying the average 2–10 keV flux with the outburst duration ( $t_{\text{ob}}$ , given in weeks). Average ( $L_X$ ) and peak ( $L_X^{\text{peak}}$ ) luminosities are in units of  $10^{35} \text{ erg s}^{-1}$  and were calculated by assuming a distance of  $D = 8 \text{ kpc}$  for AX J1745.6–2901 and  $D = 6.7 \text{ kpc}$  for GRS 1741–2853.

## 2. New Outbursts from AX J1745.6–2901 and GRS 1741–2853

Figure 1 displays the updated X-ray light curves of AX J1745.6–2901 and GRS 1741–2853, including new *Swift*/XRT data obtained in 2010–2013. Both sources exhibited two new accretion outbursts. We fitted the average spectra of each outburst to an absorbed power-law model. We calculated the 2–10 keV fluxes and fluences, and determined the outburst peak intensity. The results are summarized in Table 1. No X-ray bursts were detected from the two sources in the 2010–2013 *Swift* data.

AX J1745.6–2901 entered an outburst between 2010 June 11 and 15 and remained active till October 31, after which the Galactic center became Sun constrained. When the observations resumed on 2011 February 4, the source had faded to the background level, implying an outburst duration of  $\simeq 20\text{--}34$  weeks. Renewed activity was detected on 2013 July 18 and continued until the observations ended on 2013 November 5, implying an outburst duration of  $\gtrsim 16$  weeks. GRS 1741–2853 was seen in outburst starting on 2010 July 18 and remained active for  $\simeq 13$  weeks. The source was again active for  $\simeq 6$  weeks from 2013 August 1 till September 14.

## 3. Summary and Outlook

In the past seven years, AX J1745.6–2901 and GRS 1741–2853 have each displayed four distinct outbursts captured by the *Swift*/XRT (Figure 1). The main outbursts of GRS 1741–2853 (i.e., neglecting the mini-outburst observed in 2006; Figure 1) have varying peak intensities and lengths, yet comparable fluencies (Table 1, see also Degenaar & Wijnands 2010). AX J1745.6–2901 displays two types of outbursts: those in 2006 and 2010 were relatively faint ( $L_X \simeq 4 \times 10^{35} \text{ erg s}^{-1}$ ) and short (months), whereas the 2007–2008 outburst was much brighter ( $L_X \simeq 2 \times 10^{36} \text{ erg s}^{-1}$ ) and longer (1.5 yr). The peak luminosity detected in 2013 was similar to that of the 2007–2008 outburst. If the duration is also similar, the source might still be active when the Galactic center becomes observable again in 2014 February. However, it was argued by Degenaar & Wijnands (2010) that long and bright outbursts can only recur on a time scale of a decade.

## References

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